

PATENT APPLICATION



09158290

jc551 U.S. PTO

09/158290



09/22/98

INITIALS

CONTENTS

Date received
(Incl. C. of M.)
or
Date Mailed

Date received
(Incl. C. of M.)
or
Date Mailed

1. Application papers.

2. *10 dec.*

3. *Response (1) mtr*

4. *Restriction*

5. *IDS*

6. *Election*

7. *Fig. 3 mtr*

8. *Amtd A / Three mtr E.D.T 327-00*

9. *Ex. Amtd B*

10. *Amtd C (Rule 32)*

11. *Supp Notice*

12.

13.

14.

15.

16.

17.

18.

19.

20.

21.

22.

23.

24.

25.

26.

27.

28.

29.

30.

31.

32.

33.

34.

35.

36.

37.

38.

39.

40.

41.

42.

43.

44.

45.

46.

47.

48.

49.

50.

51.

52.

53.

54.

55.

56.

57.

58.

59.

60.

61.

62.

63.

64.

65.

66.

67.

68.

69.

70.

71.

72.

73.

74.

75.

76.

77.

78.

79.

80.

81.

82.

(FRONT)

SEARCHED

Class	Sub.	Date	Exmr.
156	298 312	13 Sep 99	FJL
<hr/>			
		updated 1 Jun 00	FJL

SEARCH NOTES
(INCLUDING SEARCH STRATEGY)

Date	Exmr.
13 Sep 99	FJL
reviewed parent	

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
156	298 312	1 Jun 00	FJL

(RIGHT OUTSIDE)

POSITION	INITIALS	ID NO.	DATE
FEE DETERMINATION	JG.		9/30/98
O.I.P.E. CLASSIFIER		43	10/1/98
FORMALITY REVIEW		101008	10-8-98

INDEX OF CLAIMS

- ✓

.....

Rejected
- =

.....

Allowed
- (Through numeral)

Canceled
- ÷

.....

Restricted
- N

.....

Non-elected
- I

.....

Interference
- A

.....

Appeal
- O

.....

Objected

Claim		Date			
Final	Original				
1	1	10/1/98			
2	2	10/1/98			
3	3	10/1/98			
4	4	10/1/98			
5	5	10/1/98			
6	6	10/1/98			
7	7	10/1/98			
8	8	10/1/98			
9	9	10/1/98			
10	10	10/1/98			
11	11	10/1/98			
12	12	10/1/98			
13	13	10/1/98			
14	14	10/1/98			
15	15	10/1/98			
16	16	10/1/98			
17	17	10/1/98			
18	18	10/1/98			
19	19	10/1/98			
20	20	10/1/98			
21	21	10/1/98			
22	22	10/1/98			
23	23	10/1/98			
24	24	10/1/98			
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					

Claim		Date			
Final	Original				
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					
61					
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					
76					
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					
91					
92					
93					
94					
95					
96					
97					
98					
99					
100					

Claim		Date			
Final	Original				
110					
112					
113					
114					
115					
116					
117					
118					
119					
120					
121					
122					
123					
124					
125					
126					
127					
128					
129					
130					
131					
132					
133					
134					
135					
136					
137					
138					
139					
140					
141					
142					
143					
144					
145					
146					
147					
148					
149					
150					

If more than 150 claims or 10 actions
staple additional sheet here

(LEFT INSIDE)



US006214155B1

(12) **United States Patent**
Leighton

(10) **Patent No.:** **US 6,214,155 B1**
(45) **Date of Patent:** **Apr. 10, 2001**

(54) **RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS**

(76) Inventor: **Keith R. Leighton**, 2817 Fulmer Rd., Lorain, OH (US) 44053

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

4,980,802	12/1990	Champagne et al.	361/764
5,067,008	11/1991	Yanaka et al.	257/703
5,097,117	3/1992	Champagne et al.	235/488
5,173,840	12/1992	Kodai et al.	361/737
5,208,450	5/1993	Uenishi et al.	235/492
5,268,699	12/1993	Laute et al.	343/702
5,272,596	12/1993	Honore et al.	361/633
5,396,650	3/1995	Terauchi	455/38.2
5,412,192	5/1995	Hoss	235/380
5,438,750	8/1995	Venambre	29/829
5,567,362	10/1996	Grun	264/1.31
5,809,633	9/1998	Mundigl et al.	29/600.3

(21) Appl. No.: **09/158,290**
(22) Filed: **Sep. 22, 1998**

Primary Examiner—Francis J. Lorin
(74) *Attorney, Agent, or Firm*—Oldham & Oldham Co., L.P.A.

Related U.S. Application Data

(63) Continuation of application No. 08/727,789, filed on Oct. 7, 1996, now Pat. No. 5,817,207.
(60) Provisional application No. 60/005,685, filed on Oct. 17, 1995.
(51) Int. Cl.⁷ **B32B 31/20**
(52) U.S. Cl. **156/298; 156/312**
(58) Field of Search **156/298, 312**

(57) **ABSTRACT**

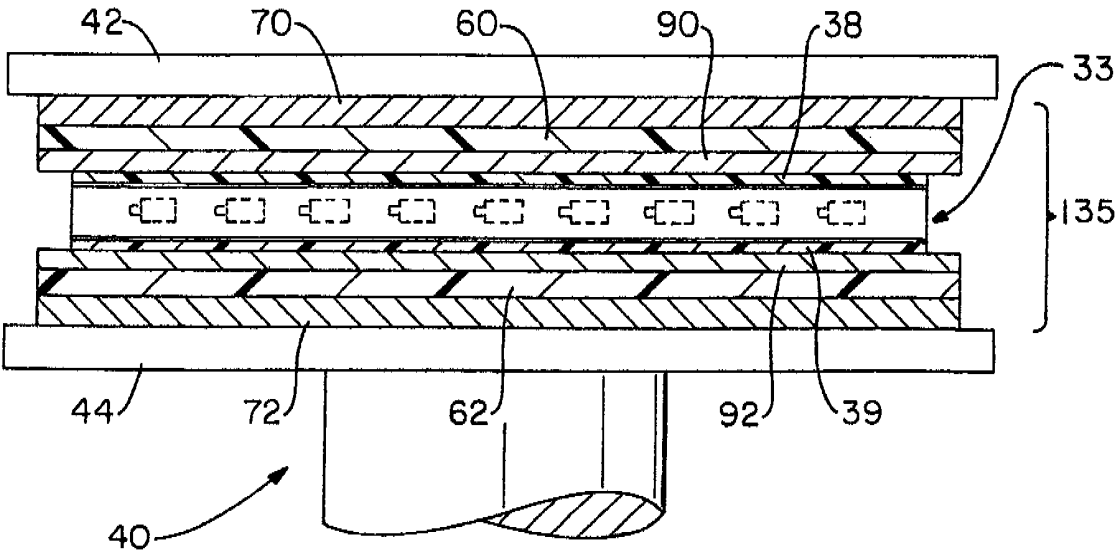
A plastic card, such as a radio frequency identification card, including at least one electronic element embedded therein and a hot lamination process for the manufacture of radio frequency identification cards and other plastic cards including a micro-chip embedded therein. The process results in a card having an overall thickness in the range of 0.028 inches to 0.032 inches with a surface suitable for receiving dye sublimation printing—the variation in card thickness across the surface is less than 0.0005 inches. A card manufactured in accordance with the present invention also complies with all industry standards and specifications. Also, the hot lamination process of the present invention results in an aesthetically pleasing card. The invention also relates to a plastic card formed in accordance with the hot lamination process of the present invention.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,994,225	11/1976	Sitzberger	101/485
4,450,024	5/1984	Haghiri-Tehran et al.	156/108
4,701,236	10/1987	Vieilledent	156/252
4,792,843	12/1988	Haghiri-Tehrani et al.	257/679
4,795,898	1/1989	Bernstein et al.	235/487
4,841,134	6/1989	Hida et al.	235/488

16 Claims, 3 Drawing Sheets



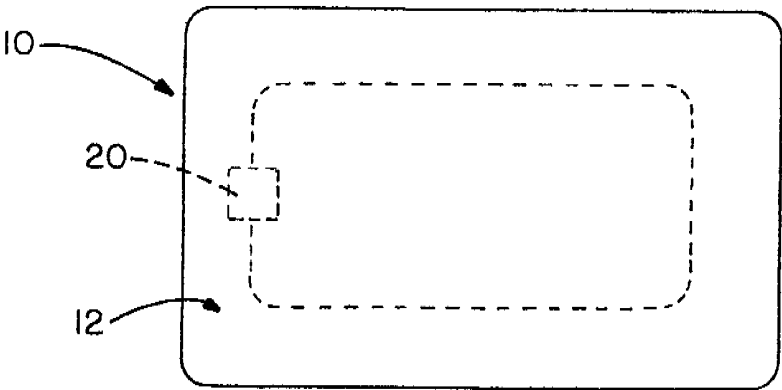


FIG. - 1

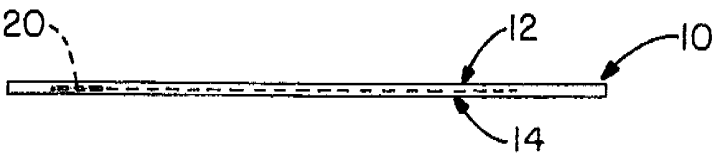


FIG. - 2

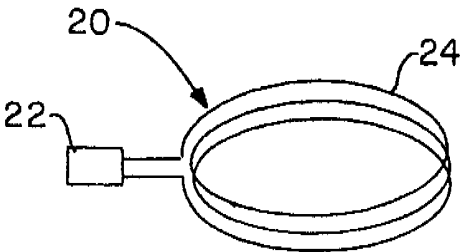


FIG. - 3A

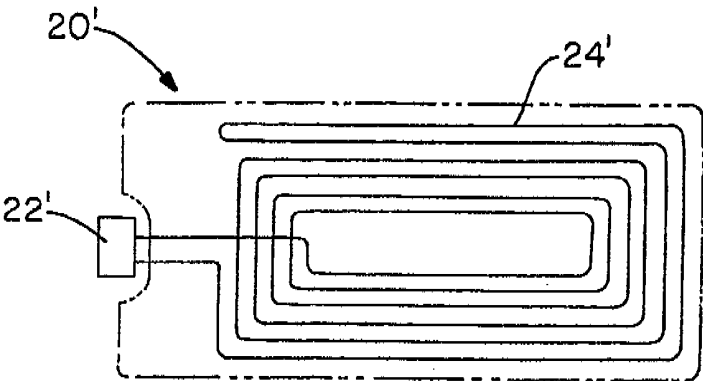


FIG. - 3B

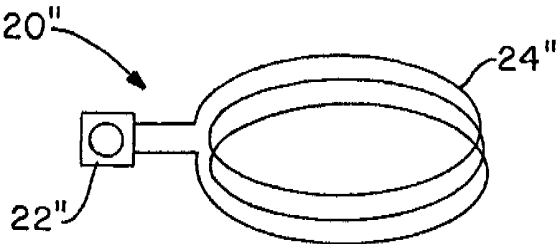


FIG. - 3C

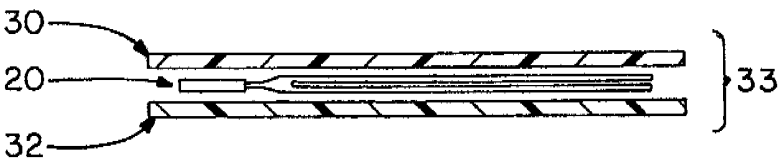


FIG. - 4

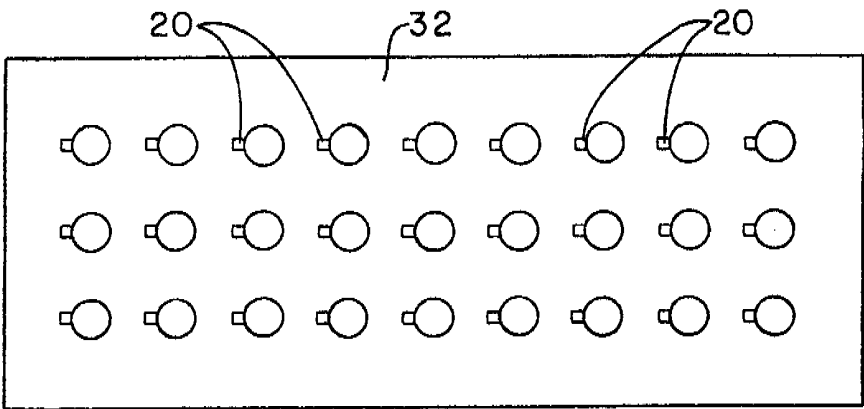


FIG. - 5

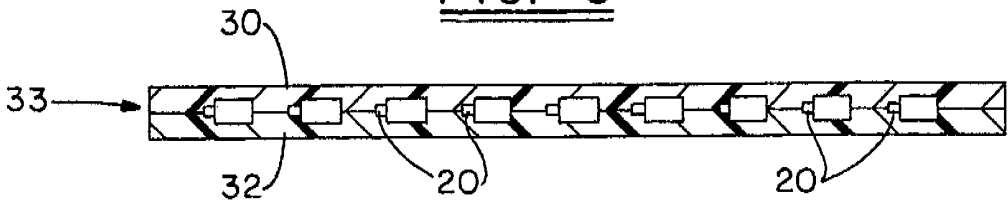


FIG. - 6

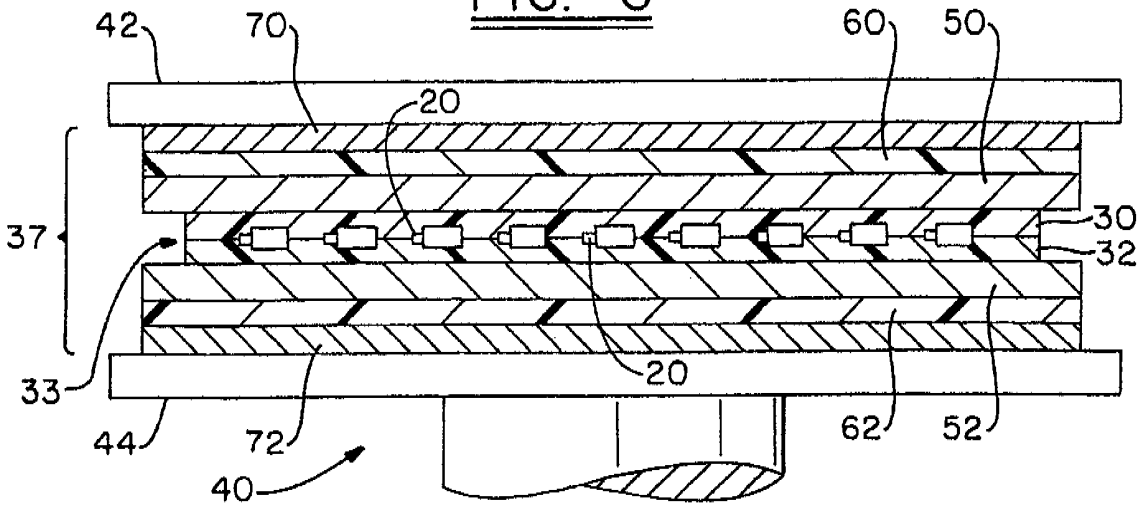


FIG. - 7

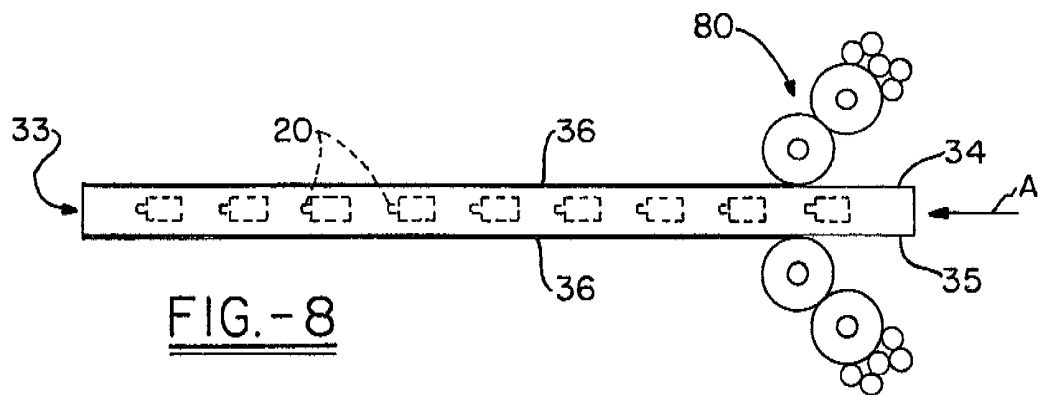


FIG. - 8

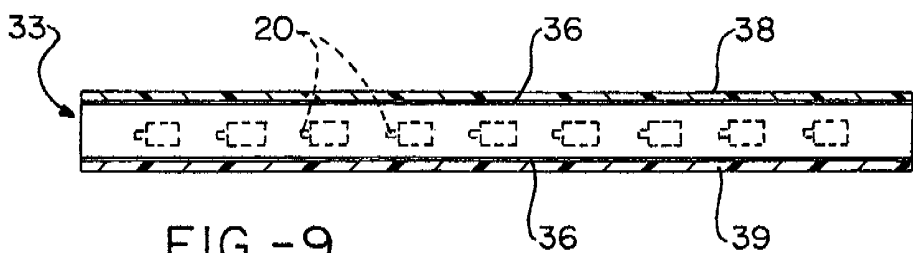


FIG. - 9

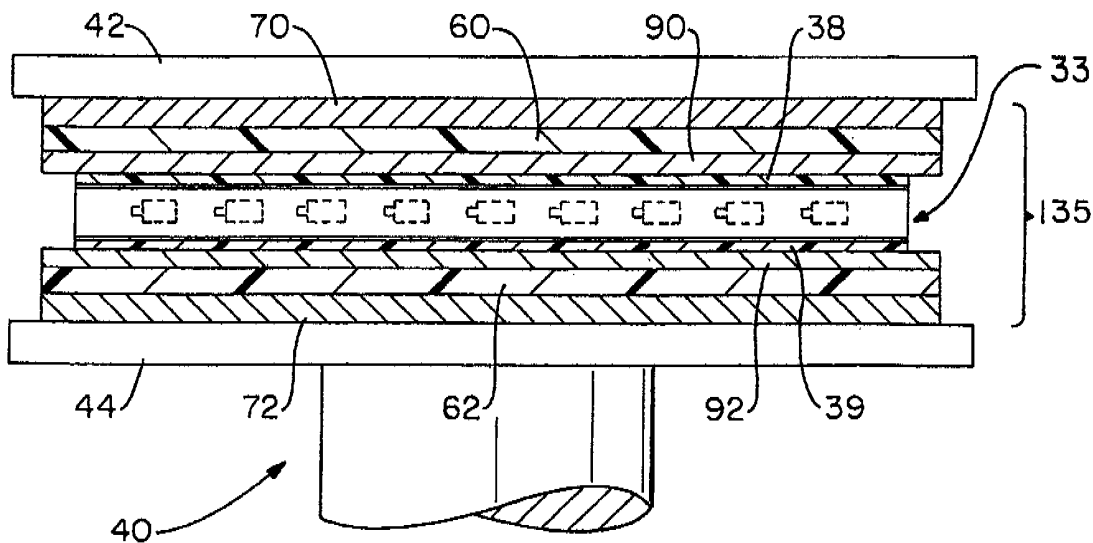


FIG. - 10

US 6,214,155 B1

1

RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS

This application is a continuation of Ser. No. 08/727,789, now U.S. Pat. No. 5,817,207 which claim the benefit of provision of application 60/005,685 filed on Oct. 17, 1995.

FIELD OF THE INVENTION

The present invention relates generally to plastic cards and the manufacture thereof, and more particularly to radio frequency identification (RFID) cards and the manufacture of RFID cards that conform to industry size and performance standards and conventions and that have a superior outer surface to known RFID cards such that card may receive dye sublimation printing or the like.

BACKGROUND OF THE INVENTION

As the use of plastic cards for credit cards, automated teller machine (ATM) cards, identification cards, and like continues to become more widespread, the problems associated with the use of such cards correspondingly increase. Credit card fraud and identification card fraud are becoming larger problems everyday, and this fraud has introduced uncertainties into our systems of commerce and our security systems. Using easily available technology, criminals are able to manufacture credit/debit cards, ATM cards, identification cards, and the like having another's account code, identification code, or other personal information embedded in the magnetic stripe thereof. Thus, for example, criminals may steal hundreds or thousands of legitimate credit card account numbers and manufacture many additional cards bearing the stolen information. These fraudulent cards are then usable by the criminals to purchase goods and to receive cash with the legitimate card holder and the card issuer left holding the bill. Likewise, so called debit cards are becoming increasingly popular. These cards have stored thereon a certain amount of value for which the card owner has previously paid. For example, a subway rider may purchase a card good for 50 fares, with one fare being deducted from the card each time the owner rides the subway. Criminals have also been able to manipulate the data stored on these cards to defraud the merchants and others.

The ease in which criminals have been able to manufacture and or manipulate known cards results from the existence of the easily altered magnetic stripe storage medium used by known cards. These magnetic stripes are easily programmed and reprogrammed using commonly available technology. Thus, there has been found a need in the plastic card industry to provide a more secure plastic card that is very difficult or impossible to fraudulently manipulate. The most likely solution to the above-noted problems associated with known plastic cards is the RFID card and other cards including computer chips embedded therein rather than, or in addition to, a magnetic stripe. While these RFID cards and like have been found to be successful in preventing or limiting fraud, they are more difficult and expensive to manufacture relative to ordinary magnetic stripe cards. One of the biggest obstacles to the wide spread manufacture and use of RFID cards has been the inability of card manufacturers to manufacture an RFID card that meets all industry standards and specifications, such as those set by the International Standards Organization (ISO), that are sufficiently aesthetically pleasing (wherein the embedded electronics are

2

hidden from view), and that have a sufficiently regular or flat surface such that one or both surfaces of the card may be printed on using the very popular and widespread dye sublimation technology. Known plastic cards with computer chips and like embedded therein are too thick to work in connection with existing card reading machinery (ATM machines, telephones, and like) and have a surface that is too irregular to properly and consistently receive dye sublimation printing. Furthermore, prior attempts to manufacture a sufficiently thin plastic card including a computer chip embedded therein have resulted in a card with inferior aesthetic qualities such as the ability to see the embedded computer chip through the plastic.

SUMMARY OF THE INVENTION

The present invention is therefore directed to a plastic card having at least one electronic element embedded therein and to a hot lamination method for the manufacture of plastic cards including at least one electronic element therein. The card has an overall thickness in the range of 0.028 inches to 0.032 inches and comprises a plastic core having at least one electronic element embedded therein with at least one of the upper and lower surfaces of the core comprising a coating printed or otherwise applied thereon. An overlamine film is preferably provided over the coated surface of the core and the resulting card has a variation in thickness across the surfaces thereof of no greater than approximately 0.0005 inches. The hot lamination method of the present invention comprises the steps of providing first and second plastic core sheets, positioning at least one electronic element between the first and second core sheets to thus form a core, and placing the core in a laminator and closing the laminator without applying laminator ram pressure to the core. A heat cycle is applied to the core sheets in the laminator thus liquefying or partially liquefying the sheets. The laminator ram pressure is then increased in combination with the heat. A cooling cycle is then applied to the core in the laminator, preferably with an associated increase in ram pressure, and the core is removed from the laminator. At least one surface of the core is then printed on using a printing press or similar printing apparatus, a sheet of overlamine film is placed on at least one side of the core, and the core is then again placed in a laminator. A heat cycle is applied to the core with its overlamine film, and a cooling cycle is thereafter applied, resulting in a sheet of plastic card stock from which one or more cards may be cut. The invention is also directed to a card manufactured in accordance with the above process which results in a plastic card having a thickness in the range of approximately 0.028 inches to 0.032 inches with a surface smoothness of at least approximately 0.0005 inches as is required by ISO and American National Standards Institute (ANSI) standards.

The present invention provides numerous advantages over known plastic cards and known plastic card manufacturing processes, including the formation of a plastic card with electronic elements such as a computer chip embedded therein with a pleasing aesthetic appearance, with a sufficiently smooth and regular surface such that the card may receive dye sublimation printing, and with sufficient durability and characteristics to comply with all industry specifications and standards.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a plastic card in accordance with the present invention;

FIG. 2 is a side elevational view of the card shown in FIG. 1;

3

FIGS. 3A-3C are top plan views of various electronic elements that may be embedded in a card in accordance with the present invention;

FIG. 4 is an exploded, schematic view of an electronic element position between two plastic core sheets to form a core;

FIG. 5 is a top plan view of a plurality of electronic elements positioned on a sheet of plastic core stock such that they may be covered by a similar sheet of core stock;

FIG. 6 is a schematic cross-sectional view of one or more electronic elements positioned between sheets of plastic core stock;

FIG. 7 schematically illustrates a book comprising the core, as it is positioned in a laminator apparatus;

FIG. 8 schematically illustrates the core as it is being printed on after removal from the laminator using a printing press or similar printing apparatus;

FIG. 9 is a cross-sectional view schematically illustrating the application of an overlamine film to at least one side of the core;

FIG. 10 schematically illustrates the core with overlamine film, as it is placed in a laminator for final processing to form a sheet of card stock.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a plastic card including at least one electronic element embedded therein. The present invention also relates to a hot lamination process for the manufacture of plastic cards, and more particularly to a hot lamination process for the manufacturer of plastic cards that include an electronic element, such as a computer chip or other electronic element embedded therein. The electronic element may perform a wide variety of functions and take a wide variety of forms. Such cards, without regard to the particular electronic element embedded therein, will hereinafter be referred to as radio frequency identification (RFID) cards. The present invention also relates to a card formed in accordance with the invention.

Referring now to FIG. 1, there can be seen a plastic RFID card 10 manufactured in accordance with the present invention and including an electronic element 20 embedded therein. Card 10 includes an upper surface 12 and a lower surface 14. Electronic element 20 may take a wide variety of forms and perform a wide variety of functions. As shown in FIGS. 3A-3C respectively, electronic element 20, 20', 20" may be provided by a micro-chip 22 including a wire antenna 24 connected thereto, a micro-chip 22' and a circuit board antenna 24', a read/write micro-chip 22" and a wire coil antenna 24", or any other suitable electronic element. These electronic elements 20, 20', 20" and their insertion into plastic cards is not new, however, the present invention provides a new hot lamination process for manufacturing plastic cards 10 with these electronic elements 20, 20', 20" embedded therein such that the cards 10 are of a superior quality, such that the cards 10 meet all ISO and other industry specifications and standards, in such that at least one of the upper and lower surfaces 12, 14 of card 10 is sufficiently smooth and is otherwise is capable of receiving dye sublimation printing. Specifically, a card in accordance with the present invention has a thickness of approximately in the range of 0.028 inches to 0.032 inches with a surface smoothness of 0.0005 inches.

As shown in FIGS. 4-10 one or more cards 10 in accordance with the present invention may be manufactured

4

by positioning an electronic element 20 between first and second sheets of card stock 30, 32 to form a core 33. Preferably is shown in FIGS. 5-10, a plurality of cards are manufactured simultaneously, in thus, a plurality of electronic elements 20 are positioned between the first and second sheets of plastic core stock 30, 32 (only the second sheet 32 begin shown in FIG. 5 for clarity). When a plurality of electronic elements 20 are positioned between first and second sheets plastic core stock 30, 32, electronic elements 20 are properly positioned relative to one another such that a plurality cards may be cut from the resulting card stock. Plastic core sheets 30, 32 may be provided by a wide variety of plastics, the preferred being polyvinyl chloride (PVC) having a thickness in the range of 0.007 inches to 0.024 inches and preferably having a thickness of approximately 0.0125 inches each. Those skilled in the art will recognize that the thickness of the plastic core sheets will depend upon the thickness of the one or more electronic elements that are to be embedded therebetween. Other suitable plastics that may be utilized include polyester, acrylonitrile-butadiene-styrene (ABS), and any other suitable plastic.

Subsequent to placing one or more electronic elements 20 between the first and second sheets 30, 32 of plastic core stock to form a core 33, this core 33 is placed in a laminator apparatus 40 of the type well known in the art of plastic card manufacturing. As is shown in FIG. 7, laminator 40 includes upper and lower platens 42, 44 for applying ram pressure to an article positioned therebetween. In addition to the ability to apply ram pressure, laminator 40 is preferably of the type having controlled platens 42, 44 that may provide both heat and chill cycles and preferably includes cycle timer to regulate cycle time. Core 33 is positioned between first and second laminating plates 50, 52, one of which is preferably matte finished to provide laminated core 33 with at least one textured outer surface. First and second laminating pads 60, 62 are positioned outside of the laminating plates 50, 52, and first and second steel plates 70, 72 are likewise positioned outside of pads of 60, 62 and the entire assembly forms a book 35 for being positioned in laminator 40 between platens 42, 44.

Once book 35 is positioned in laminator 40 as shown in FIG. 7, the first lamination cycle is initiated by closing laminator platens 42, 44, preferably applying little or no ram pressure to book 35. A laminator heat cycle is initiated, bringing the temperature of platens 42,44 up to a range of 275° F. to 400° F., and most preferably up to a range of 300° F. to 370° F. for a period of greater than 5 minutes, and preferably in the range of 7 to 10 minutes. Once the heat cycle has been applied to the book 35 as is set forth above, the ram pressure of laminator 40 is increased to facilitate the flow of the plastic core sheets 30, 32 so that the one or more electronic elements 20 are encapsulated there by, and so that sheets 30, 32 form a uniform core 33 (seen most clearly in FIGS. 8-10) with upper and lower surfaces 34, 35. As mentioned, the use of matte finished laminator plates 50, 52 provides surfaces 34, 35 with a slightly roughened or textured quality which will facilitate the application of a coating thereto as is discussed below. The ram pressure applied during the heat cycle and the length of the heat cycle may vary, depending especially upon the size of sheets 30, 32. For example, the cycle time may be in the range of 10-15 minutes. In one example, a ram pressure of 940.135 pounds per square inch (p.s.i.) was applied for 10-15 minutes to form a uniform core 33, using sheets 30, 32 of a size in the range of 12 inches by 24 inches to 24 inches by 36 inches.

Subsequent to the above heat cycle, laminator 40 applies a chill cycle to book 35 during which time the ram pressure

US 6,214,155 B1

5

of the laminator 40 is increased, preferably by approximately 25% until the platens 42, 44 have cooled to approximately 40° F. to 65° F. for approximately 10–15 minutes. Core 33 may then be removed from laminator 40 for additional processing.

Subsequent to the removal of core 33 from laminator 40, and as illustrated in FIG. 8, core 33 is coated on at least one of its upper and lower surfaces 34, 35 with a layer of printing ink 36. This may be accomplished using a wide variety of printing techniques such as offset printing, letterpress printing, screen printing, roller coating, spray printing, litho-printing, and other suitable printing techniques. As shown in FIG. 8, core 33 is fed in the direction indicated with arrow A through a printing press, a lithographic printer, or a similar apparatus 80. This printing step is performed to coat at least one surface 34, 35 of core 33 with a layer of aesthetically pleasing ink 36. This layer of ink 36 cosmetically hides the one or more electronic elements 20 that are embedded within core 33, and prevents these one or more electronic elements 20 from showing through the relatively thin core 33. In this manner, the one or more electronic elements 20 encapsulated in core 33 are completely hidden from view without requiring the plastic used in the manufacture core 33 to be excessively thick.

Referring now to FIGS. 9–10, the final processing of core 33, which now comprises a layer of ink 36 or the like on at least one surface 34, 35 thereof, is schematically illustrated. A layer of overlamine film such as clear overlamine film 38, 39 is positioned on at least one ink coated surface 34, 35 of core 33, and preferably core 33 is positioned between two similar sheets of overlamine film 38, 39 as shown. Overlamine film is very thin, for example in the range of 0.0015" thick. A book 135 is then constructed for insertion into laminator 40 as is schematically illustrated FIG. 10. Book 135 comprising core 33, including at least one layer of ink 36 and at least one layer of overlamine film 38, 39 is positioned between laminating plates which are preferably highly polished plates such as mirror finished stainless steel plates 90, 92. Book 135 also comprises first and second laminating pads 60, 62 and first and second steel plates 70, 72 as is discussed above in relation to FIG. 7.

When book 135 is positioned between upper and lower platens 42, 44 of laminator 40 as shown in FIG. 10, the laminator is closed and a heat cycle in the range of 175° F. to 300° F., and most preferably in the range of 180° F. to 275° F., is applied to book 135 for a period of 10 to 25 minutes with a ram pressure that varies depending upon sheet size or the ram size of the laminator 40, but which is typically approximately 1000 p.s.i. with an 18 inch diameter ram. The laminator 40 is then caused to execute a chill cycle, preferably with a corresponding increase in ram pressure. For example, the chill temperature may be in the range of 40° F. to 65° F. and last for a period of 10 to 25 minutes. A ram pressure increase of approximately 25% over the pressure used for the heat cycle has been found to be most preferable.

Subsequent to the above described second lamination cycle as illustrated in FIG. 10, a sheet of plastic card stock is provided which comprises at least core 33 with at least one surface 34, 35 thereof covered by a layer of ink 36, and with at least one surface 34, 35 thereof covered by a layer of overlamine film 38, 39. Preferably plastic card stock manufactured in accordance with the present invention comprises core 33 covered on both surfaces 34, 35 with a layer of ink 36 which is positioned between layers of overlamine film 38, 39, all of which has been laminated together as described. One or more cards 10 then may be cut

6

from the resulting plastic card stock and card 10 will have a thickness in the range of 0.028 inches to 0.032 inches with variation in overall thickness across the surfaces 12, 14 thereof being no greater than approximately 0.0005 inches.

The one or more cards 10 can thus be said to have a surface smoothness of approximately 0.0005 inches or better. Thus, a card 10 manufactured in accordance with the present invention includes at least one surface 12, 14 at preferably both surfaces 12, 14 that are sufficiently smooth and regular to receive dye sublimation printing.

Those skilled in the art will recognize that the foregoing description has set forth the preferred embodiment of the invention in particular detail and it must be understood that numerous modifications, substitutions, and changes may be undertaken without departing from the true spirit and scope of the present invention as defined by the ensuing claims.

What is claimed is:

1. A process for incorporating at least one electronic element in the manufacture of a plastic card, comprising the steps of:

- (a) providing first and second plastic core sheets;
- (b) positioning said at least one electronic element in the absence of a non-electronic carrier directly between said first and second plastic core sheets to form a core, said plastic core sheets defining a pair of inner and outer surfaces of said core;
- (c) positioning said core in a laminator apparatus, and subjecting said core to a heat and pressure cycle, said heat and pressure cycle comprising the steps of:
 - (i) heating said core for a first period of time;
 - (ii) applying a first pressure to said core for a second period of time such that said at least one electronic element is encapsulated by said core;
 - (iii) cooling said core while applying a second pressure to said core,
- (d) applying a layer of overlamine film to at least one of said outer surfaces of said core.

2. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said laminator apparatus has first and second laminating plates, at least one of said first and second laminating plates having a matte finish for creating a textured surface on at least one of said outer surfaces of said core.

3. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 2, wherein each of said first and second laminating plates has a matte finish for creating said textured surface on both of said outer surfaces of said core.

4. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said first and second plastic core sheets are made from a material selected from the group consisting of polyvinyl chloride, polyester, and acrylonitrile-butadiene-styrene, each of said sheets having a thickness in the range of 0.007 to 0.024 inch.

5. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 4, wherein said first and second plastic core sheets have a thickness of approximately 0.0125 inch.

6. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said second pressure is greater than said first pressure.

7. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in

US 6,214,155 B1

7

claim 6, wherein said second pressure is at least approximately 25% greater than said first pressure.

8. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said core is heated in step (c)(i) to a temperature in the range of 275° F. to 400° F. and said first period of time is at least five (5) minutes.

9. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said first pressure is approximately 1000 p.s.i. and said second period of time is at least 10 minutes.

10. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said step (d) of applying a layer of overlamine film comprises the further steps of:

- (a) positioning an overlamine film on at least one surface of said core;
- (b) subjecting said core to a second heat and pressure cycle comprising the steps of:
 - (i) heating said core to a temperature between approximately 175° F. to 300° F. for approximately 10 to 25 minutes;
 - (ii) applying approximately 1000 p.s.i. pressure to said core, and
 - (iii) cooling said core to a temperature in the range of approximately 40° F. to 65° F. for approximately 10 to 25 minutes.

11. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said at least one electronic element is a micro-chip and an associated wire antenna.

12. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in

8

claim 1, wherein said at least one electronic element is a micro-chip and an associated circuit board antenna.

13. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said at least one electronic element is a read/write integrated chip and an associated antenna.

14. A plastic card constructed in accordance with claim 1.

15. A hot lamination process for the manufacture of plastic cards, said process comprising the steps of:

- (a) providing first and second plastic core sheets;
- (b) positioning at least one electronic element in the absence of a non-electronic carrier directly between said first and second plastic core sheets to form a layered core;
- (c) positioning said core in a laminator apparatus, and subjecting said core to a heat and pressure cycle, said heat and pressure cycle comprising the steps of:
 - (i) heating said core in said laminator, in the presence of a minimal first ram pressure, to a temperature which causes controlled flow of said plastic which makes up said first and second plastic core sheets;
 - (ii) applying a second pressure uniformly across said core for encapsulating said at least one electronic element within said controlled flow plastic;
 - (iii) subsequently cooling said core in conjunction with the concurrent application of a third pressure uniformly across said core, said core including and upper and lower surfaces.

16. The method as recited in claim 15 wherein said first and second core layers are devoid of any appreciable cut-outs.

* * * * *

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

10/01/1998 JARTIS 00000013 09158290

01 FC:201	395.00 OP
02 FC:203	22.00 OP
03 FC:998	1.00 OP

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/158,290	09/22/98	430 <u>156</u>	<u>1752</u> <u>1785</u>	6014-1-CON

ATTORNEY
KEITH R. LEIGHTON, LORAIN, OH.

****CONTINUING DOMESTIC DATA******* LORAIN 1732
VERIFIED THIS APPLN IS A CON OF 08/727,789 10/07/96 PAT 5,817,207
PROVISIONAL APPLICATION NO. 60/005,685 10/17/95
FSL

****371 (NAT'L STAGE) DATA*******
VERIFIED
FSL

****FOREIGN APPLICATIONS*******
VERIFIED
FSL

FOREIGN FILING LICENSE GRANTED 10/08/98 ***** SMALL ENTITY *****

Foreign Priority claimed <input type="checkbox"/> yes <input checked="" type="checkbox"/> no 35 USC 119 (a-d) conditions met <input type="checkbox"/> yes <input checked="" type="checkbox"/> no <input type="checkbox"/> Met after Allowance	STATE OR COUNTRY OH	SHEETS DRAWING 3	TOTAL CLAIMS 22	INDEPENDENT CLAIMS 2
Verified and Acknowledged <u>FSL</u> Examiner's Initials Initials				

SEE CUSTOMER NUMBER: 021324

ADDRESS

TITLE
RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS

FILING FEE RECEIVED \$482	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT NO. _____ for the following:	<input type="checkbox"/> All Fees <input type="checkbox"/> 1.16 Fees (Filing) <input type="checkbox"/> 1.17 Fees (Processing Ext. of time) <input type="checkbox"/> 1.18 Fees (Issue) <input type="checkbox"/> Other _____ <input type="checkbox"/> Credit
----------------------------------	---	---

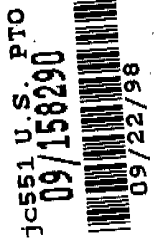


Practitioner's Docket No. 6014-1-CON

PATENT *A*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231



NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

Inventor: Keith R. Leighton

For (title): RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION
PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY
IDENTIFICATION CARDS

1. Type of Application

This transmittal is for a continuation application.

2. Benefit of Prior U.S. Applications (35 U.S.C. 119(e), 120, or 121)

The new application being transmitted claims the benefit of prior U.S. applications. Enclosed are
ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S.
APPLICATIONS CLAIMED.

3. Papers Enclosed

A. Required for filing date under 37 C.F.R. 1.53(b) (Regular) or 37 C.F.R. 1.153
(Design) Application

8 Page(s) of Specification
4 Page(s) of Claims
3 Sheet(s) of Drawing(s)—Formal

B. Other Papers Enclosed

1 Page(s) of Abstract

CERTIFICATION UNDER 37 C.F.R. 1.10*

I hereby certify that this correspondence and the documents referred to as attached therein are being deposited with the United States Postal Service on this date 22 September 1998, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EL053709560US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Mark A. Watkins
(type or print name of person mailing paper)

Mark A. Watkins
Signature of person mailing paper

(Application Transmittal—page 1 of 4)

09158290-092298

4. Declaration or Oath

Not Enclosed.

Application is made by a person authorized under 37 C.F.R. 1.41(c) on behalf of the above-named inventor.

5. Inventorship Statement

The inventorship for all the claims in this application is the same.

6. Language

English

7. Fee Calculation (37 C.F.R. 1.16)

Regular Application

CLAIMS AS FILED					
Claims	Number Filed	Basic Fee Allowance	Number Extra	Rate	Basic Fee 37 CFR 1.16(a) \$790.00
Total Claims (37 CFR 1.16(c))	22	- 20 =	2 x	\$22.00	\$44.00
Independent Claims (37 CFR 1.16(b))	2	- 3 =	0 x	\$82.00	\$0.00
Multiple Dependent Claim(s), if any (37 CFR 1.16(d))			+	\$270.00	

Filing Fee Calculation

\$836.00
Regular Filing
Fee

862260-06285160

8. Fee Payment Being Made at This Time

Enclosed

Filing Fee	\$836.00 Basic Filing Fee
Total Fees Enclosed	\$836.00 Fee Payment

9. Small Entity Statement(s)

- ☒ Verified Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 were filed in parent application no. 08/727,789 on 7 October 1996.

Filing Fee Calculation (50% of 8 above)	\$418.00
---	----------

10. Method of Payment of Fees

Check in the amount of \$418.00 is attached.

11. Authorization to Charge Additional Fees

The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 15-0450.

- ☒ 37 C.F.R. 1.16(a), (f) or (g) (filing fees)

12. Instructions as to Overpayment

Refund.

09150290-092298
082260-06205160

**ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF
PRIOR U.S. APPLICATIONS CLAIMED**

13. Relate Back

Amend the specification by inserting, before the first line, the following sentence:

A. 35 U.S.C. §§ 120, 121 and 365(c)

"This application is a continuation of copending application Application number 08/727,789 filed on October 17, 1996."

"The nonprovisional application designated above, namely application 08/727,789, filed October 17, 1996, claims the benefit of U.S. Provisional Application No. 60/005,685 filed on October 17, 1995."

14. Maintenance of Copendency of Prior Application

A. Conditional Petition for Extension of Time in Prior Application

A conditional petition for extension of time is being filed in the pending **prior** application.

15. Further Inventorship Statement Where Benefit of Prior Application(s) Claimed

- a. This application discloses and claims only subject matter disclosed in the prior application whose particulars are set out above and the inventor in this application is the same.

16. Petition for Suspension of Prosecution for the Time Necessary to File an Amendment

There is provided herewith a Petition to Suspend Prosecution for the Time Necessary to File an Amendment (New Application Filed Concurrently).

17. NOTIFICATION IN PARENT APPLICATION OF THIS FILING

A notification of the filing of this continuation is being filed in the parent application, from which this application claims priority under 35 U.S.C. § 120.


SIGNATURE OF PRACTITIONER

Reg. No. 33,813
Tel. No.: (330) 864-5550
Customer No.: 021324

Mark A. Watkins
Oldham & Oldham Co., L.P.A.
1225 W. Market St.
Akron, OH 44313

09/158292

13

Abstract

A plastic card, such as a radio frequency identification card, including at least one electronic element embedded therein and a hot lamination process for the manufacture of radio frequency identification cards and other plastic cards including a micro-chip embedded therein. The process results in a card having an overall thickness in the range of 0.028 inches to 0.032 inches with a surface suitable for receiving dye sublimation printing - the variation in card thickness across the surface is less than 0.0005 inches. A card manufactured in accordance with the present invention also complies with all industry standards and specifications. Also, the hot lamination process of the present invention results in an aesthetically pleasing card. The invention also relates to a plastic card formed in accordance with the hot lamination process of the present invention.

09158292-06285160

**RADIO FREQUENCY IDENTIFICATION CARD
AND HOT LAMINATION PROCESS FOR THE MANUFACTURE
OF RADIO FREQUENCY IDENTIFICATION CARDS**

4-15-99
Linda
B

Ins. A which claim the benefit of provisional application 601005.685 filed on October 17, 1995.

The present invention relates generally to plastic cards and the manufacture thereof, and more particularly to radio frequency identification (RFID) cards and the manufacture of RFID cards that conform to industry size and performance standards and conventions and that have a superior outer surface to known RFID cards such that card may receive dye sublimation printing or the like.

Background of the Invention

As the use of plastic cards for credit cards, automated teller machine (ATM) cards, identification cards, and like continues to become more widespread, the problems associated with the use of such cards correspondingly increase. Credit card fraud and identification card fraud are becoming larger problems everyday, and this fraud has introduced uncertainties into our systems of commerce and our security systems. Using easily available technology, criminals are able to manufacture credit/debit cards, ATM cards, identification cards, and the like having another's account code, identification code, or other personal information embedded in the magnetic stripe thereof. Thus, for example, criminals may steal hundreds or thousands of legitimate credit card account numbers and manufacture many additional cards bearing the stolen information. These fraudulent cards are then usable by the criminals to purchase goods and to receive cash with the legitimate card holder and the card issuer left holding the bill. Likewise, so called debit cards are becoming increasingly popular. These cards have stored thereon a certain amount of value for which the card owner has previously paid. For example, a subway rider may purchase a card good for 50 fares, with one fare being deducted from the card each time the owner rides the subway. Criminals have also been able to manipulate the data stored on these cards to defraud the merchants and others.

The ease in which criminals have been able to manufacture and or manipulate known cards results from the existence of the easily altered magnetic stripe storage medium used by known cards. These magnetic stripes are easily programmed and reprogrammed using

09158290-092293

2

commonly available technology. Thus, there has been found a need in the plastic card industry to provide a more secure plastic card that is very difficult or impossible to fraudulently manipulate. The most likely solution to the above-noted problems associated with known plastic cards is the RFID card and other cards including computer chips embedded therein rather than, or in addition to, a magnetic stripe. While these RFID cards and like have been found to be successful in preventing or limiting fraud, they are more difficult and expensive to manufacture relative to ordinary magnetic stripe cards. One of the biggest obstacles to the wide spread manufacture and use of RFID cards has been the inability of card manufacturers to manufacture an RFID card that meets all industry standards and specifications, such as those set by the International Standards Organization (ISO), that are sufficiently aesthetically pleasing (wherein the embedded electronics are hidden from view), and that have a sufficiently regular or flat surface such that one or both surfaces of the card may be printed on using the very popular and widespread dye sublimation technology. Known plastic cards with computer chips and like embedded therein are too thick to work in connection with existing card reading machinery (ATM machines, telephones, and like) and have a surface that is too irregular to properly and consistently receive dye sublimation printing. Furthermore, prior attempts to manufacture a sufficiently thin plastic card including a computer chip embedded therein have resulted in a card with inferior aesthetic qualities such as the ability to see the embedded computer chip through the plastic.

Summary of the Invention

The present invention is therefore directed to a plastic card having at least one electronic element embedded therein and to a hot lamination method for the manufacture of plastic cards including at least one electronic element therein. The card has an overall thickness in the range of 0.028 inches to 0.032 inches and comprises a plastic core having at least one electronic element embedded therein with at least one of the upper and lower surfaces of the core comprising a coating printed or otherwise applied thereon. An overlamine film is preferably provided over the coated surface of the core and the resulting card has a variation in thickness across the surfaces thereof of no greater than approximately 0.0005 inches. The hot lamination method of the present invention comprises the steps of providing first and second plastic core

09158290-092298 062260-06285160

3

3

09158290-06225760

sheets, positioning at least one electronic element between the first and second core sheets to thus form a core, and placing the core in a laminator and closing the laminator without applying laminator ram pressure to the core. A heat cycle is applied to the core sheets in the laminator thus liquefying or partially liquefying the sheets. The laminator ram pressure is then increased in combination with the heat. A cooling cycle is then applied to the core in the laminator, preferably with an associated increase in ram pressure, and the core is removed from the laminator. At least one surface of the core is then printed on using a printing press or similar printing apparatus, a sheet of overlamine film is placed on at least one side of the core, and the core is then again placed in a laminator. A heat cycle is applied to the core with its overlamine film, and a cooling cycle is thereafter applied, resulting in a sheet of plastic card stock from which one or more cards may be cut. The invention is also directed to a card manufactured in accordance with the above process which results in a plastic card having a thickness in the range of approximately 0.028 inches to 0.032 inches with a surface smoothness of at least approximately 0.0005 inches as is required by ISO and American National Standards Institute (ANSI) standards.

The present invention provides numerous advantages over known plastic cards and known plastic card manufacturing processes, including the formation of a plastic card with electronic elements such as a computer chip embedded therein with a pleasing aesthetic appearance, with a sufficiently smooth and regular surface such that the card may receive dye sublimation printing, and with sufficient durability and characteristics to comply with all industry specifications and standards.

Brief Description of The Drawings

Fig. 1 is a top plan view of a plastic card in accordance with the present invention;

Fig. 2 is a side elevational view of the card shown in Fig. 1;

Figs. 3A-3C are top plan views of various electronic elements that may be embedded in a card in accordance with the present invention;

Fig. 4 is an exploded, schematic view of an electronic element position between two plastic core sheets to form a core;

4

Fig. 5 is a top plan view of a plurality of electronic elements positioned on a sheet of plastic core stock such that they may be covered by a similar sheet of core stock;

Fig. 6 is a schematic cross-sectional view of one or more electronic elements positioned between sheets of plastic core stock;

Fig. 7 schematically illustrates a book comprising the core, as it is positioned in a laminator apparatus;

Fig. 8 schematically illustrates the core as it is being printed on after removal from the laminator using a printing press or similar printing apparatus;

Fig. 9 is a cross-sectional view schematically illustrating the application of an overlamine film to at least one side of the core;

Fig. 10 schematically illustrates the core with overlamine film, as it is placed in a laminator for final processing to form a sheet of card stock.

Detailed Description of the Invention

The present invention relates to a plastic card including at least one electronic element embedded therein. The present invention also relates to a hot lamination process for the manufacture of plastic cards, and more particularly to a hot lamination process for the manufacturer of plastic cards that include an electronic element, such as a computer chip or other electronic element embedded therein. The electronic element may perform a wide variety of functions and take a wide variety of forms. Such cards, without regard to the particular electronic element embedded therein, will hereinafter be referred to as radio frequency identification (RFID) cards. The present invention also relates to a card formed in accordance with the invention.

Referring now to Fig. 1, there can be seen a plastic RFID card 10 manufactured in accordance with the present invention and including an electronic element 20 embedded therein. Card 10 includes an upper surface 12 and a lower surface 14. Electronic element 20 may take a wide variety of forms and perform a wide variety of functions. As shown in Fig. 3A -3C respectively, electronic element 20, 20', 20" may be provided by a micro-chip 22 including a wire antenna 24 connected thereto, a micro-chip 22' and a circuit board antenna 24', a read/write micro-chip 22" and a wire coil antenna 24", or any other suitable electronic element. These

09158290.09298
862260.06285160

5

electronic elements 20, 20', 20" and their insertion into plastic cards is not new, however, the present invention provides a new hot lamination process for manufacturing plastic cards 10 with these electronic elements 20, 20', 20" embedded therein such that the cards 10 are of a superior quality, such that the cards 10 meet all ISO and other industry specifications and standards, in such that at least one of the upper and lower surfaces 12, 14 of card 10 is sufficiently smooth and is otherwise is capable of receiving dye sublimation printing. Specifically, a card in accordance with the present invention has a thickness of approximately in the range of 0.028 inches to 0.032 inches with a surface smoothness of 0.0005 inches.

As shown in Figs. 4-10 one or more cards 10 in accordance with the present invention may be manufactured by positioning an electronic element 20 between first and second sheets of card stock 30, 32 to form a core 33. Preferably is shown in Fig. 5-10, a plurality of cards are manufactured simultaneously, in thus, a plurality of electronic elements 20 are positioned between the first and second sheets of plastic core stock 30, 32 (only the second sheet 32 begin shown in Fig. 5 for clarity). When a plurality of electronic elements 20 are positioned between first and second sheets plastic core stock 30, 32, electronic elements 20 are properly positioned relative to one another such that a plurality cards may be cut from the resulting card stock. Plastic core sheets 30, 32 may be provided by a wide variety of plastics, the preferred being polyvinyl chloride (PVC) having a thickness in the range of 0.007 inches to 0.024 inches and preferably having a thickness of approximately 0.0125 inches each. Those skilled in the art will recognize that the thickness of the plastic core sheets will depend upon the thickness of the one or more electronic elements that are to be embedded therebetween. Other suitable plastics that may be utilized include polyester, acrylonitrile-butadiene-styrene (ABS), and any other suitable plastic.

Subsequent to placing one or more electronic elements 20 between the first and second sheets 30, 32 of plastic core stock to form a core 33, this core 33 is placed in a laminator apparatus 40 of the type well known in the art of plastic card manufacturing. As is shown in Fig. 7, laminator 40 includes upper and lower platens 42, 44 for applying ram pressure to an article positioned therebetween. In addition to the ability to apply ram pressure, laminator 40 is preferably of the type having controlled platens 42, 44 that may provide both heat and chill cycles and preferably includes cycle timer to regulate cycle time. Core 33 is positioned between

6

first and second laminating plates 50, 52, one of which is preferably matte finished to provide laminated core 33 with at least one textured outer surface. First and second laminating pads 60, 62 are positioned outside of the laminating plates 50, 52, and first and second steel plates 70, 72 are likewise positioned outside of pads of 60, 62 and the entire assembly forms a book 35 for being positioned in laminator 40 between platens 42, 44.

Once book 35 is positioned in laminator 40 as shown in Fig. 7, the first lamination cycle is initiated by closing laminator platens 42, 44, preferably applying little or no ram pressure to book 35. A laminator heat cycle is initiated, bringing the temperature of platens 42, 44 up to a range of 275°F to 400°F, and most preferably up to a range of 300°F to 370°F for a period of greater than 5 minutes, and preferably in the range of 7 to 10 minutes. Once the heat cycle has been applied to the book 35 as is set forth above, the ram pressure of laminator 40 is increased to facilitate the flow of the plastic core sheets 30, 32 so that the one or more electronic elements 20 are encapsulated there by, and so that sheets 30, 32 form a uniform core 33 (seen most clearly in Figs. 8-10) with upper and lower surfaces 34, 35. As mentioned, the use of matte finished laminator plates 50, 52 provides surfaces 34, 35 with a slightly roughened or textured quality which will facilitate the application of a coating thereto as is discussed below. The ram pressure applied during the heat cycle and the length of the heat cycle may vary, depending especially upon the size of sheets 30, 32. For example, the cycle time may be in the range of 10-15 minutes. In one example, a ram pressure of 940.135 pounds per square inch (p.s.i.) was applied for 10-15 minutes to form a uniform core 33, using sheets 30, 32 of a size in the range of 12 inches by 24 inches to 24 inches by 36 inches.

Subsequent to the above heat cycle, laminator 40 applies a chill cycle to book 35 during which time the ram pressure of the laminator 40 is increased, preferably by approximately 25% until the platens 42, 44 have cooled to approximately 40°F to 65°F for approximately 10-15 minutes. Core 33 may then be removed from laminator 40 for additional processing.

Subsequent to the removal of core 33 from laminator 40, and as illustrated in Fig. 8, core 33 is coated on at least one of its upper and lower surfaces 34, 35 with a layer of printing ink 36. This may be accomplished using a wide variety of printing techniques such as offset printing, letterpress printing, screen printing, roller coating, spray printing, litho-printing, and other suitable printing techniques. As shown in Fig. 8, core 33 is fed in the direction indicated with

7

arrow A through a printing press, a lithographic printer, or a similar apparatus 80. This printing step is performed to coat at least one surface 34, 35 of core 33 with a layer of aesthetically pleasing ink 36. This layer of ink 36 cosmetically hides the one or more electronic elements 20 that are embedded within core 33, and prevents these one or more electronic elements 20 from showing through the relatively thin core 33. In this manner, the one or more electronic elements 20 encapsulated in core 33 are completely hidden from view without requiring the plastic used in the manufacture core 33 to be excessively thick.

Referring now to Figs. 9-10, the final processing of core 33, which now comprises a layer of ink 36 or the like on at least one surface 34, 35 thereof, is schematically illustrated. A layer of overlamine film such as clear overlamine film 38, 39 is positioned on at least one ink coated surface 34, 35 of core 33, and preferably core 33 is positioned between two similar sheets of overlamine film 38, 39 as shown. Overlamine film is very thin, for example in the range of 0.0015" thick. A book 135 is then constructed for insertion into laminator 40 as is schematically illustrated Fig. 10. Book 135 comprising core 33, including at least one layer of ink 36 and at least one layer of overlamine film 38, 39 is positioned between laminating plates which are preferably highly polished plates such as mirror finished stainless steel plates 90, 92. Book 135 also comprises first and second laminating pads 60, 62 and first and second steel plates 70, 72 as is discussed above in relation to Fig. 7.

When book 135 is positioned between upper and lower platens 42, 44 of laminator 40 as shown in Fig. 10, the laminator is closed and a heat cycle in the range of 175° F to 300° F, and most preferably in the range of 180°F to 275°F, is applied to book 135 for a period of 10 to 25 minutes with a ram pressure that varies depending upon sheet size or the ram size of the laminator 40, but which is typically approximately 1000 p.s.i. with an 18 inch diameter ram. The laminator 40 is then caused to execute a chill cycle, preferably with a corresponding increase in ram pressure. For example, the chill temperature may be in the range of 40° F to 65° F and last for a period of 10 to 25 minutes. A ram pressure increase of approximately 25% over the pressure used for the heat cycle has been found to be most preferable.

Subsequent to the above described second lamination cycle as illustrated in Fig. 10, a sheet of plastic card stock is provided which comprises at least core 33 with at least one surface 34, 35 thereof covered by a layer of ink 36, and with at least one surface 34, 35 thereof covered

0915890 09298

8

by a layer of overlamine film 38, 39. Preferably plastic card stock manufactured in accordance with the present invention comprises core 33 covered on both surfaces 34, 35 with a layer of ink 36 which is positioned between layers of overlamine film 38, 39, all of which has been laminated together as described. One or more cards 10 then may be cut from the resulting plastic card stock and card 10 will have a thickness in the range of 0.028 inches to 0.032 inches with variation in overall thickness across the surfaces 12, 14 thereof being no greater than approximately 0.0005 inches. The one or more cards 10 can thus be said to have a surface smoothness of approximately 0.0005 inches or better. Thus, a card 10 manufactured in accordance with the present invention includes at least one surface 12, 14 at preferably both surfaces 12, 14 that are sufficiently smooth and regular to receive dye sublimation printing.

Those skilled in the art will recognize that the foregoing description has set forth the preferred embodiment of the invention in particular detail and it must be understood that numerous modifications, substitutions, and changes may be undertaken without departing from the true spirit and scope of the present invention as defined by the ensuing claims.

00152290.092299
362260.06225160

9

What is claimed is:

1. A hot lamination process for the manufacture of a plastic card, said process comprising the steps of:
- (a) providing first and second plastic core sheets;
 - (b) positioning at least one electronic element between said first and second plastic core sheets to form a layered core;
 - (c) positioning said core in a laminator apparatus, heating said core in said laminator, thereafter applying ram pressure to said core such that said at one electronic element is encapsulated in said core, and thereafter cooling said core in conjunction with laminator ram pressure being applied to said core, said core including an upper and lower surfaces;
 - (d) printing on at least one of said upper and lower surfaces of said core such that a layer of ink is applied to said at least one upper and lower surface of said core;
 - (e) positioning said core in a laminator apparatus with a layer of overlamine film on at least one of said upper and lower surfaces of said core and laminating said layer of overlamine film to said core in said laminator to thereby form a sheet of plastic card stock; and,
 - (f) cutting at least one card from said sheet of plastic card stock.
2. A hot lamination process as recited in claim 1, wherein said step (c) of positioning said core in a laminator apparatus is carried out by positioning said core between first and second laminating plates, at least one of said first and second laminating plates having a matte finish to provide at least one of said upper and lower core surfaces with a correspondingly textured surface.
3. A hot lamination process as recited in claim 2, wherein each of said first and second laminating plates includes matte finish to provide both of said upper and lower surfaces of said core with a correspondingly textured surface.
4. A hot lamination process as recited in claim 1, wherein said first and second plastic core sheets are made from a material selected from the group consisting of polyvinyl chloride,

09158290-092398
862360-06235150

10

polyester, and acrylonitrile-butadiene-styrene, wherein each of said sheets has a thickness in the range of 0.007 inches to 0.024 inches.

5. A hot lamination process as recited in claim 4, wherein said first and second plastic core sheets have a thickness of approximately 0.0125 inches.

6. A hot lamination process as recited in claim 1, wherein said step (c) is carried out by:

(c1) constructing a first book including said core and at least first and second laminating plates respectively adjacent to said upper and lower surfaces of said core ;

(c2) positioning said book in said laminator apparatus;

(c3) closing said laminator apparatus and heating said core for a first predetermined amount of time without applying essentially any laminator ram pressure to said core;

(c4) increasing said laminator ram pressure following the passage of said first predetermined amount of time to apply pressure to said core in conjunction with said heating of said core; and,

(c5) cooling said core in said laminator in conjunction with laminator ram pressure being applied to said core.

7. A hot lamination process as recited in claim 6, wherein said step (c5) is carried out with a ram pressure that is greater than the ram pressure utilized in step (c4).

8. A hot lamination process as recited in claim 7, wherein the laminator pressure utilized in step (c5) is at least approximately 25% greater than the ram pressure utilized in step (c4).

9. A hot lamination process as recited in step 6, wherein at least one of said first and second laminating plates is a matte finished laminating plate to provide at least one of said upper and lower surfaces of said core with a corresponding matte finish.

10. A hot lamination process as recited in claim 9, wherein both of said first and second laminating plates are matte finished laminating plates to provide each of said upper and lower

09158290-09158290-06285160

11

surfaces of said core with a corresponding matte finish.

11. A hot lamination process as recited in claim 6, wherein said step (c3) is carried out by heating said core to a temperature in the range of 300°F to 370°F for at least 5 to 10 minutes.

12. A hot lamination process as recited in claim 11, wherein said step (c4) is carried out by increasing said laminator ram pressure to a pressure approximately in the range of 700 p.s.i. to 1000 p.s.i. for at least 10 minutes.

13. A hot lamination process as recited in claim 1, wherein said step (d) is carried out utilizing a printing press.

14. A hot lamination process as recited in claim 1, wherein said step (d) is carried out utilizing a coating techniques selected from the group consisting of silk screen printing, offset printing, letterpress printing, screen printing, roller coating, spray printing, and litho-printing.

15. A hot lamination process as recited in claim 1, wherein said step (e) is carried out by positioning said core between first and second sheets of overlamine film such that a layer of overlamine film is laminated to both said upper and lower surfaces of said core.

16. A hot lamination process as recited in claim 1, wherein said at least one electronic element is a micro-chip and an associated wire antenna.

17. A hot lamination process as recited in claim 1, wherein said at least one electronic element is a micro-chip and an associated circuit board antenna.

18. A hot lamination process as recited in claim 1, wherein said at least one electronic element is a read/write integrated chip and an associated antenna.

09158290-062298

12

19. A hot lamination process as recited in claim 1, wherein said step (e) is carried out by positioning said core with said layer of overlamine film in said laminator apparatus between first and second laminating plates, wherein at least one of said first and second laminating plates includes a highly polished surface in contact with said layer of overlamine film.

~~14~~
20. A plastic card constructed in accordance with claim 1.

21. A plastic card comprising:

a plastic core including at least one electronic element embedded therein, said core having an upper surface and a lower surface;

a coating on at least one of said upper and lower surfaces; and,

a layer of overlamine film positioned on said at least one coated surface, wherein said card has an overall thickness in the range of approximately 0.028 inches to 0.032 inches with a variation in overall thickness across the upper and lower surfaces being no greater than approximately 0.0005 inches.

22. A plastic card as recited in claim 21, wherein said core is made from a plastic selected from the group consisting of polyvinyl chloride, polyester, and acrylonitrile-butadiene-styrene

09158290 092260

add
Alk 7

PRINT OF DRAWING
AS ORIGINALLY FI

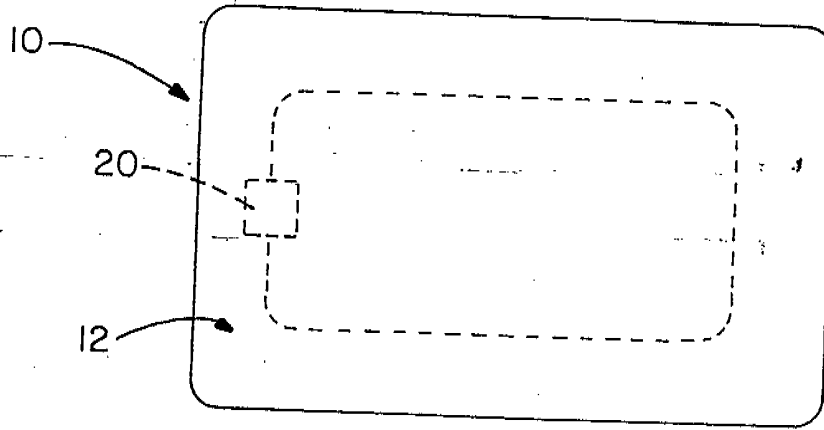


FIG. - 1

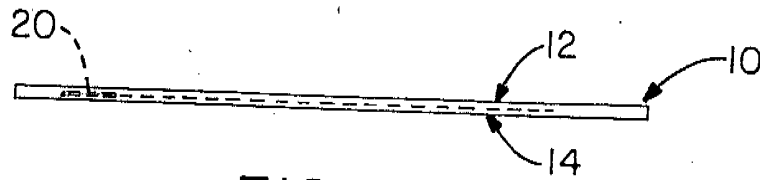


FIG. - 2

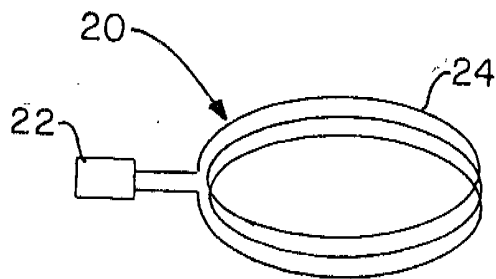


FIG. - 3A

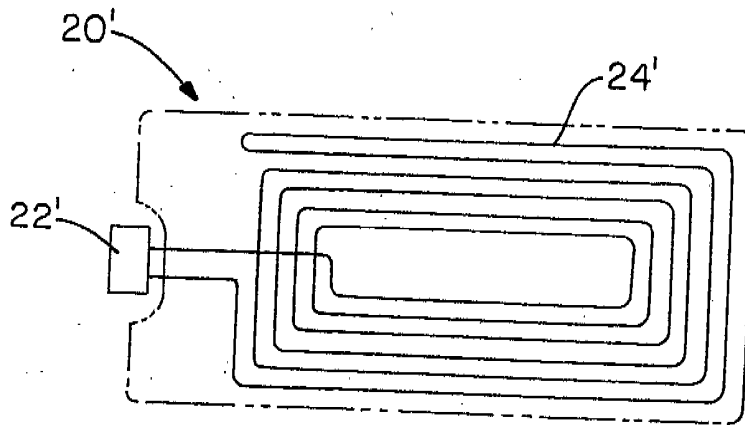


FIG. - 3B

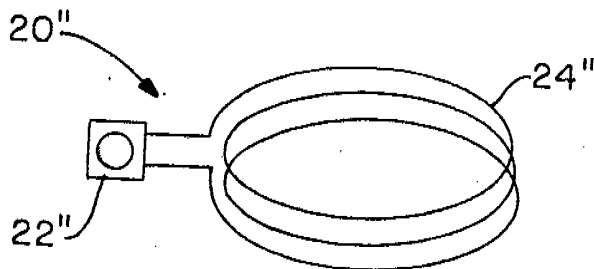


FIG. - 3C

09158290-09298

PRINT OF DRAWING
AS ORIGINALLY FILED

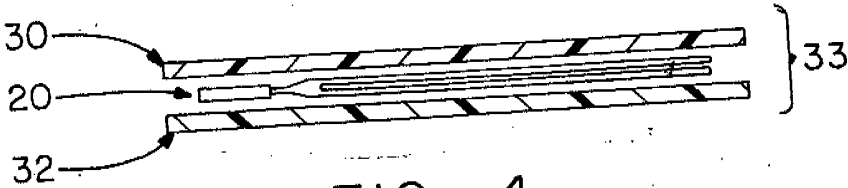


FIG. - 4

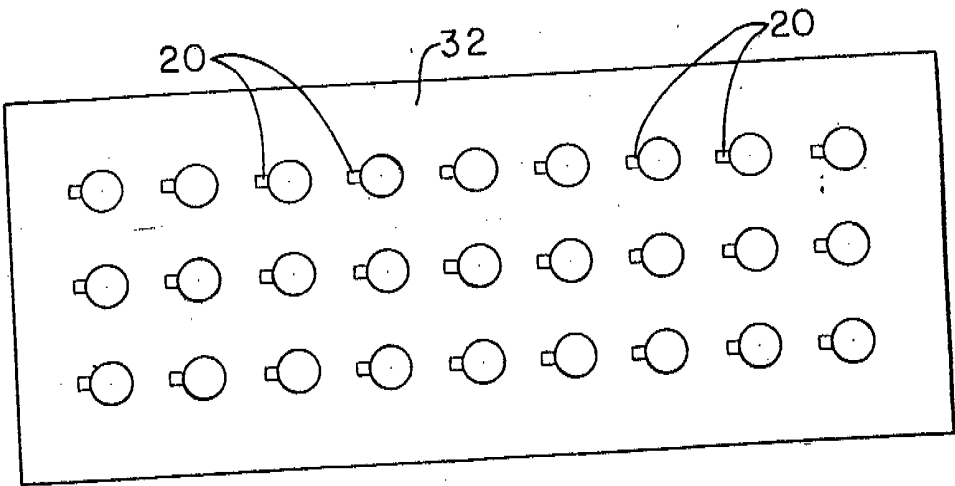


FIG. - 5

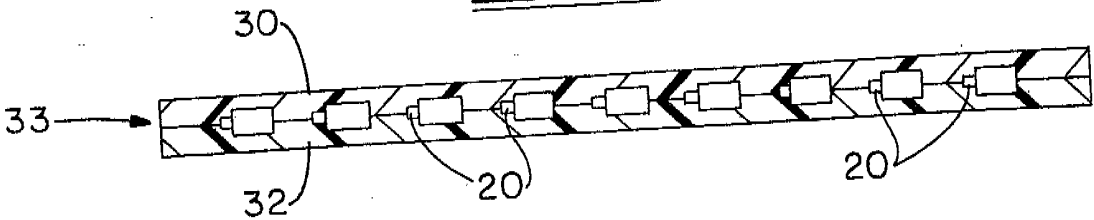


FIG. - 6

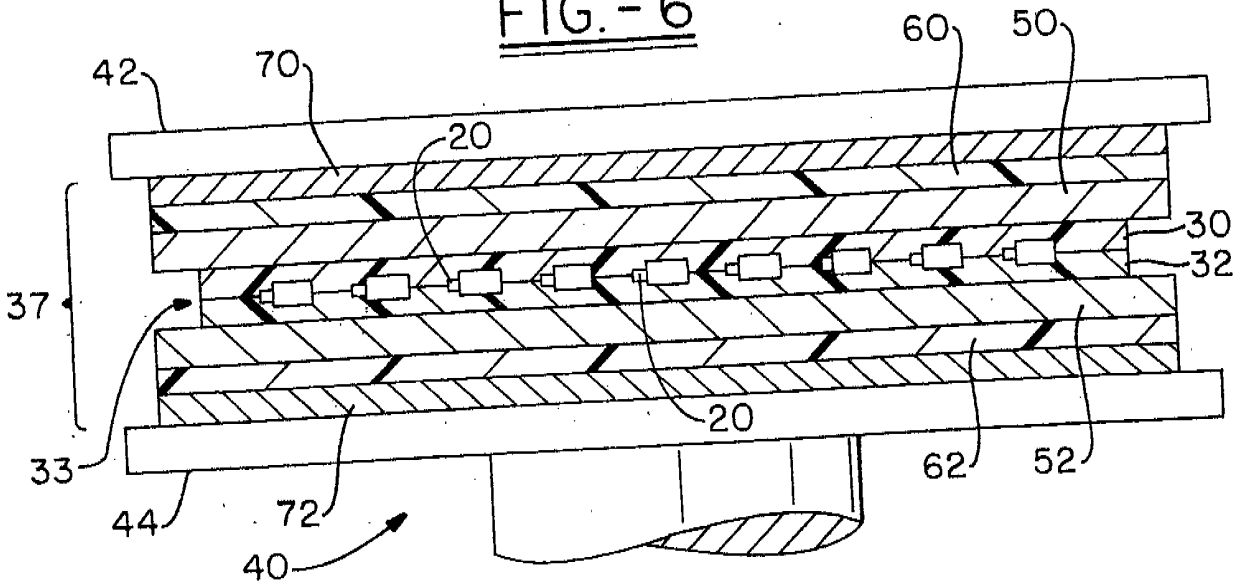
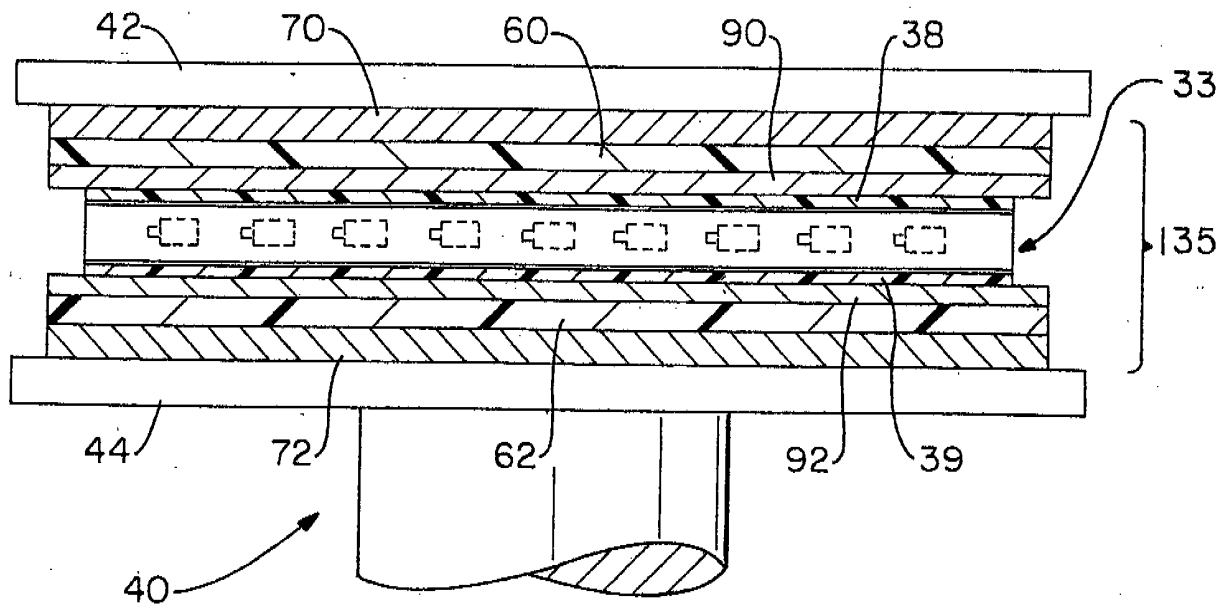
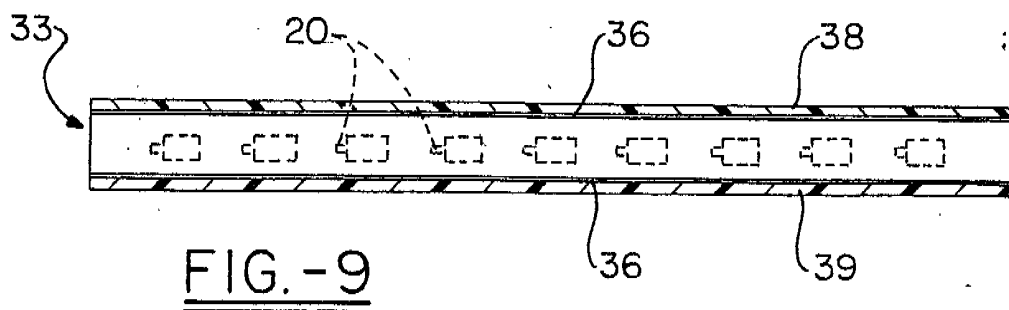
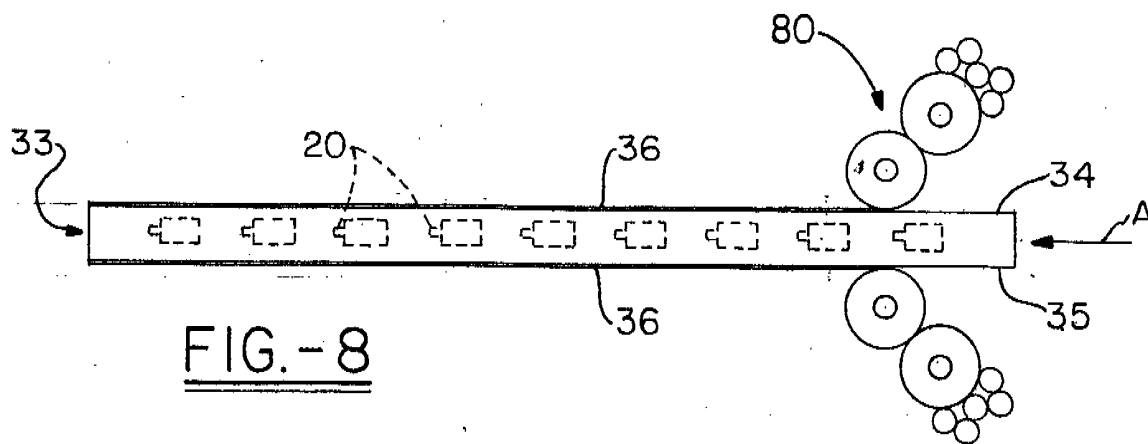


FIG. - 7

862260-06285160

PRINT OF DRAWING
AS ORIGINALLY FILED



062260 06285160



UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO./TITLE
--------------------	---------------------	-----------------------	---------------------------

0041541, 0000 0041541, 0000 0041541, 0000

0041541, 0000 0041541, 0000 0041541, 0000

0041541

0041541

0041541, 0000 0041541, 0000 0041541, 0000

0041541, 0000 0041541, 0000 0041541, 0000

0041541, 0000 0041541, 0000 0041541, 0000

0041541, 0000 0041541, 0000 0041541, 0000

0041541, 0000 0041541, 0000 0041541, 0000

DATE MAILED:

NOTICE TO FILE MISSING PARTS OF APPLICATION Filing Date Granted

An Application Number and Filing Date have been assigned to this application. The items indicated below, however, are missing. Applicant is given TWO MONTHS FROM THE DATE OF THIS NOTICE within which to file all required items and pay fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a). If any of items 1 or 3 through 5 are indicated as missing, the SURCHARGE set forth in 37 CFR 1.16(e) of ☐ \$65.00 for a small entity in compliance with 37 CFR 1.27, or ☐ \$130.00 for a non-small entity, must also be timely submitted in reply to this NOTICE to avoid abandonment.

If all required items on this form are filed within the period set above, the total amount owed by applicant as a

☒ small entity (statement filed) ☐ non-small entity is \$ 120.00.

☐ 1. The statutory basic filing fee is:

- ☐ missing.
- ☐ insufficient.

Applicant must submit \$ _____ to complete the basic filing fee and/or file a small entity statement claiming such status (37 CFR 1.27).

☐ 2. Additional claim fees of \$ _____, including any multiple dependent claim fees, are required.

\$ _____ for _____ independent claims over 3.

\$ _____ for _____ dependent claims over 20.

\$ _____ for multiple dependent claim surcharge.

Applicant must either submit the additional claim fees or cancel additional claims for which fees are due.

☒ 3. The oath or declaration:

- ☒ is missing or unexecuted.
- ☐ does not cover the newly submitted items.
- ☐ does not identify the application to which it applies.
- ☐ does not include the city and state or foreign country of applicant's residence.

An oath or declaration in compliance with 37 CFR 1.63, including residence information and identifying the application by the above Application Number and Filing Date is required.

☐ 4. The signature(s) to the oath or declaration is/are by a person other than inventor or person qualified under 37 CFR 1.42, 1.43 or 1.47.

A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.

☐ 5. The signature of the following joint inventor(s) is missing from the oath or declaration:

An oath or declaration in compliance with 37 CFR 1.63 listing the names of all inventors and signed by the omitted inventor(s), identifying this application by the above Application Number and Filing Date, is required.

☐ 6. A \$50.00 processing fee is required since your check was returned without payment (37 CFR 1.21(m)).

☐ 7. Your filing receipt was mailed in error because your check was returned without payment.

☐ 8. The application does not comply with the Sequence Rules.

See attached "Notice to Comply with Sequence Rules 37 CFR 1.821-1.825."

☐ 9. OTHER:

Direct the reply and any questions about this notice to "Attention: Box Missing Parts."

A copy of this notice MUST be returned with the reply.

Customer Service Center
Initial Patent Examination Division (703) 308-1202

PART 3 - OFFICE COPY